CEVE / ESCI / ENST 307/507
ENERGY AND THE ENVIRONMENT
SPRING 2016 (3 credits)

Meeting Times and Location:
T/Th 9:25 – 10:40 a.m.
Lovett College Commons

Instructor:
Daniel Cohan, Ph.D.
Associate Professor of Civil & Environmental Engineering
Office: Keck Hall 116B
Phone: 713-348-5129; Email: cohan@rice.edu

Office Hours:
Wednesdays 1:30-3:30 p.m. Visits at other times are also welcomed, via email request.

Head Teaching Assistant:
Amanda San Miguel
Email: als24@rice.edu
Office Hours: Tuesdays 1-3pm, Keck Hall 125

Course Description:
Securing sufficient, reliable, and affordable supplies of energy in an environmentally sustainable manner is among the greatest challenges facing society in the 21st century. Appreciating and addressing this complex challenge requires consideration of the various physical, technological, and societal forces that shape energy use and its impact on the environment.

This course will explore the physical principles of energy and how various sectors and fuels impact Earth's environment and climate. We will also examine policies and technologies that could foster more sustainable use of energy resources. The course will include several group projects in which teams of students will develop modules (websites, written articles, videos, etc.); design business plans for a particular energy source and assess the associated economic, environmental, regulatory, and practical implications; and consider the human and social dimensions of energy and climate.

The course will be a hybrid of traditional lectures and group projects.

First Half of Course
There will be two course tracks from which students may choose for the first half of the course:

- A "traditional" track in which students will complete written assignments and will be required to take a mid-term exam; or
- A "hybrid" track in which students will be required to complete modules (with teamwork allowed and encouraged) in support of the three Climate and Energy forums.

Second Half of Course

During the second half of the course, students will be allowed to choose to receive points and credits from the following, regardless of which track was chosen for the first half of the class:

- Similar to the first half, the completion of modules for the two remaining forums; or
- The development of a business plan.

Course Objectives and Expected Learning Outcomes:

This course aims not only to impart heightened knowledge of energy and its impacts on the environment, but also to build skills in research, analysis, and critical thinking that will catalyze a lifetime of engagement with this complex topic. Among the learning objectives for this course, students completing this course will be able to:

1) Characterize the performance of engines, heat pumps, and power plants;
2) Identify key environmental impacts of various energy sources;
3) Compute the energy return on investment, overall efficiency, levelized cost, and other metrics for an energy source;
4) Obtain objective, credible data and projections for energy availability, consumption, and impacts, and critically evaluate conflicting estimates;
5) Compare and contrast the challenges posed by regional air pollution and global climate change and their relation to energy use;
6) Critically assess conflicting evidence regarding energy technologies or policies; and
7) a. Design and present a business plan for an energy source, compute its financial and environmental impacts, and identify its practical and regulatory challenges. These will be presented and evaluated in our business plan competition in April.
   AND/OR,
   b. Organize a session for the Human and Social Dimensions of Climate and Energy forum, to be held in April.

The course addresses the following ABET student outcomes for the BSCE degree:

(a) an ability to apply knowledge of mathematics, science, and engineering;
(b) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
(c) an ability to function on multidisciplinary teams;
(d) an ability to identify, formulate, and solve engineering problems;
(e) an understanding of professional and ethical responsibility;
(f) an ability to communicate effectively;
(g) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
(h) a recognition of the need for, and an ability to engage in life-long learning; and
(i) a knowledge of contemporary issues.

Prerequisites:

Historically, physics and calculus background at least to the level of PHYS 101 and MATH 101 (or AP equivalents) have been required. These are still necessary for the problem set / midterm track. Instructor permission may be given for students without this preparation to contribute to the modules and sessions via the other track. Please contact the instructor if you have questions regarding your preparation.

Textbook and Readings:
Readings will be made available on the OwlSpace website for the course.

Honor System Policy:
All students are expected to adhere to the Rice Honor Code. For students taking exams and problem sets, the exams will be given under the honor system and must be entirely a student's own work, using only resources that are explicitly authorized for that exam. Homework assignments may be discussed with other students but must be written individually in your own words. To avoid any possibility of plagiarism, all work must be written entirely in the student's own words, citing all references used and explicitly denoting any quotes in quotations.
For the modules, academic integrity is crucial. All sources must be cited. Any quotation must be clearly denoted. Collaboration is strongly encouraged, but all products must be new for this class.

Disability Statement:
If you have a documented disability that will impact your work in this class, please contact me to discuss your needs. Additionally, you will need to contact the Disability Support Services Office in the Allen Center.

Grading:
Students will be awarded points for each task completed, and may choose which tasks to complete. Grades will be awarded as follows:

Undergraduate		**Graduate**	
Total Points at End of Semester	**Grade**	**Total Points at End of Semester**	**Grade**
100+	A+	120+	A+
93-100	A	113-120	A
90-92	A-	110-112	A-
87-89	B+	107-109	B+
83-86	B	103-106	B
80-82	B-	100-102	B-
77-79	C+	97-99	C+
73-76	C	93-96	C
70-72	C-	90-92	C-
67-69	D+	87-89	D+
63-66	D	83-86	D
60-62	D-	80-82	D-
Below 60	F	Below 80	F

*A+ is considered an exceptional grade and does not come automatically by the point scale. In addition to the point threshold, the professor reserves the right to be selective in giving A+ upon full consideration of circumstances.

Coursework:

Traditional Track

While there will be some textbook-style problems to ensure adequate development of abilities for problem-solving calculations, a key aim of this course is to engage students in critical thinking involving both quantitative and qualitative assessment of emerging scientific literature and available data resources. This higher-level thinking is crucial given the rapidly evolving nature of energy and the environment. Assignments may include short essays and analyses based on data obtained from reliable sources such as government websites or peer-reviewed publications.

All assignments are due by the specified time and date. This will most often be on Thursdays. Late assignments will incur a penalty of 25 percent and will not be accepted after solutions are distributed. Extensions will be granted only by email request describing specific extenuating circumstances.

One take-home midterm exam will be assigned in mid-March.

Hybrid Track and Climate Forum(s) in Second Half

Students will create modules for and be instrumental in the planning of a climate forum to be held in February:

- Policy and Legal Dimensions of Climate and Energy

Modules may also be directed toward forums later in the semester:

- Science Dimensions of Climate Change
- Human and Social Dimensions of Climate and Energy

Students will work in teams to plan various aspects of the climate forum, and may receive varying credit points for completing different tasks, such as developing and presenting modules, writing op-eds, and participating in "Tiger Teams." Tiger Teams may include assignments such as Why Not Translate, Why Not Share, Why Not Review, Why Not Go Green, planning/logistics, speaker solicitation, promotion/media, etc.

Business Plan

Each team will develop a business plan for the profitable and environmentally friendly use of an energy source. The plans will be aimed toward actual clients, including:

- Rice University, represented by Sustainability Director Richard Johnson
- City of Houston, represented by Lisa Lin of the Sustainability office and Jed Greenfield, fleet manager
- Renewable energy companies such as EDP Renewables, Texas Solar Outfitters
- Other clients TBD

Each group will present an oral proposal making the case for and evaluating the impacts of their plan, and a written business plan due on the last day of classes. Details of the group project will be provided later. We anticipate a full day event in April for the presentations.

Points will be awarded as follows (subject to change):

Part of Course	Track	Coursework Description	Maximum Points Awarded
First Half	Traditional	Problem Set (each)	5
		Mid-Term Exam	25
	Hybrid	Completed Module (each)	5
		Written op-ed (each)	10
		Participation in "Tiger Teams" (each)	25
Second Half	Climate/ Energy Forum(s)	Completed Module (each)	5
		Formal Presentation (each)	5
		Written op-ed (each)	10
		Participation in "Tiger Teams" (each)	25
	Human & Social Dimensions Forum	Session/room design	25
	Business Plan Competition	Group Presentation	12.5
		Group Paper	12.5
All	All	Attendance	5
		Participation	5

Details on points awarded per task and for teamwork will be provided during the course.

Attendance and Participation:

Attendance and participation in class will count 5 points each. You will be asked at the end of the semester to self-assess your performance this regard.

TENTATIVE SCHEDULE *(subject to change)*
In the first half of the semester, Tuesdays typically will be dedicated to lectures. For traditional track students, Thursdays will be used to work on problem sets. For hybrid track students, Thursdays will be used for teamwork in planning the February climate forum.

Important Dates:

Date	**Event**
February 9-11	**Forum:** Policy and Legal Dimensions of Climate Change (Feb 9-10 event in McMurtry Auditorium, followed by Feb 11 Air &Waste Management Association Hot Air Topics Event)
February 27-March 6	Spring Break – No classes
March 10 (**TENTATIVE**)	Mid-term assigned (traditional track)
March 17 (**TENTATIVE**)	Mid-term due (traditional track)
Two-day period TBD in late March	**Forum:** Science Dimensions of Climate and Energy
March 31	Mid-term recess – No class
April 12-21 (Schedule TBD)	Forum: Business plan competition
April 19-20 (**TENTATIVE)**	**Forum:** Human and Social Dimensions of Climate and Energy
April 21	Final Day of Class – Business plan group papers due approximately this date